Core Course

LS 479 - BIOSTATISTICS [2 credits]

(Prof. Rajeev Kumar, (SC&SS))

S No	Topic	Contact Hours
1.	Introduction: Applications of statistics in biology, definitions (populations, samples), Introduction to probability theory, Basic concepts, definitions to understand probability and sampling; Defining sample space, computing probability	4
2.	Random variables and probability distributions: Discrete random variables, Bernoulli random variable, binomial distribution, Poisson distribution with examples Continuous random variables, Normal random variable, other continuous distributions, Central limit theorem	4
3.	Summary statistics: measures of location and spread Measures of location: Arithmetic and other means, median, mode; when to use each measure of location Measures of spread: Variance and Standard Deviation, Standard Error; Skewness, Kurtosis; Quantiles, Outliers	3
4.	Framework for statistical analyses Framing hypothesis, The scientific method; deduction and induction; The Hypothetico-deductive method; Testing hypothesis, Significance and p-values; Type I and Type II errors, Introduction to frameworks for statistical analyses, Brief introduction to three main frameworks: Monte-carlo analysis, Parametric analysis, Bayesian analysis	5
5.	Study design Experiments & Replication: Addressing spatio-temporal variation; treatments vs. gradients, testing hypothesis; experiments – natural vs. manipulative; replicates, sample size, independence, Experimental Design**,** Regression design (for continuous predictors, gradients, randomization); Anova designs (Randomized block designs, Nested designs, Multi-factor designs)	6
6.	Data Analyses: Computing sums of squares, standard error of differences between means, T-test, Regression, Fitting data to a linear model; Variances and co-variances; least-square parametric estimates; Hypothesis test with regression; Assumptions, Analyses of variance, ANOVA and Partitioning of Sum of Squares, Assumptions; Hypothesis tests with ANOVA; Constructing F-Ratios; ANOVA tables, Analyses of categorical data, Two-way contingency tables; Chi-square and G-Test	10

Suggested Reading:

Quinn & Keough, Experimental Design and Data Analysis for Biologists, Cambridge University

Press.<http://www.lacbiosafety.org/wp-content/uploads/2011/09/experimental-design-and-data-analysis-for-biologists1.pdf>